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INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for February, 1888, and is based upon the reports of regular and voluntary observers of both countries. Descriptions of the storms that occurred over the north Atlantic Ocean are also given, and their paths shown on chart i, on which also appears the distribution of field-ice and the limits of fog-belts west of the fortieth meridian. The weather over the ocean was unusually fine for the season, and the depressions traced were deficient in number and energy, when compared with the record of corresponding months of previous years. A noteworthy feature, unparalleled in the last six years, was an entire absence of icebergs in the vicinity of Newfoundland and the Grand Banks.

In the central and upper portions of the Mississippi valley the month was decidedly colder than the average, and the temperature was generally below the normal in all districts east of the Missouri Valley to the northward of the thirty-fifth parallel. In the Southern States, Rocky Mountain and Pacific coast regions, the mean temperatures were above the normal, the departures being unusually marked in northern Rocky Mountain districts, where they amounted to 10°.

In connection with the monthly precipitation, the most important feature was the large deficiency on the Pacific coast, in the lower lake region, Ohio and central Mississippi valleys, in which districts the precipitation fell short of the average from 25 to 65 per cent.

In this REVIEW are given extracts from the monthly reports of twenty state weather services, and also from the report of the New England Meteorological Society, the territory of the latter embracing the six New England states; this is the largest number of reports of local meteorological associations that have so far been received in time to be incorporated in the REVIEW.

In the preparation of this REVIEW the following data, received up to March 20, 1888, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at 133 Signal Service stations and 24 Canadian stations, as telegraphed to this office; 177 monthly journals and 174 monthly means from the former and 24 monthly means from the latter; 307 monthly registers from voluntary observers; 60 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the Hydrographic Office, United States Navy, and the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Arkansas, Colorado, Illinois, Indiana, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New England, New Jersey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, and Tennessee, and the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for February, 1888, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

The mean pressure for the month is greatest in the northern and central Pacific coast regions and in the adjacent portions of the plateau region, the area of maximum mean pressure being inclosed by the isobar of 30.15. The mean pressure is least in Arizona, New Mexico, and western Texas, and in the extreme northeastern Canadian Provinces, where the monthly barometric means fall to 30.0, or slightly below. Over much the larger part of the United States the mean pressures range from 30.05 to 30.1. The extreme monthly means are: highest, 30.18, at Fort Bidwell, Cal.; lowest, 29.98, at Sydney, N. S.

The departures from the normal pressure at the various Signal Service stations are given in the table of miscellaneous meteorological data. Although comparison of the mean pressure of the current month with the February normal shows a general deficiency over nearly the whole country, the departures are nowhere very marked, being less than .05 in all districts, except in the Gulf States and on the Atlantic coast south of Virginia, where they range from .05 to .10. On the north Pacific coast, and in northern New England, the mean pressure is slightly above the normal.

As compared with the mean pressure of the preceding month, an increase occurs along the north Pacific coast and in

northeastern New England and the Maritime Provinces. In the first named district the increase ranges from .10 to .14 at stations near the coast, and in the latter, from .06 at Eastport, Me., to .19 at Sydney, N. S. In all other portions of the country the mean pressure of February is below that of January; over the entire region between the seventy-seventh and one hundred and seventeenth meridians the deficiency exceeds .10, and between the ninetieth and one hundredth meridians it amounts to .20, or more.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous meteorological data. The ranges, as usual, conform to the general rule, that is, they increase with the latitude and decrease slightly, though somewhat irregularly, with increasing longitude. In the states bordering on the Atlantic the extreme ranges are .43 at Key West, Fla., and 1.16 at Eastport, Me.; between the eightieth and ninetieth meridians, .59 at Cedar Keys, Fla., and 1.78 at Mackinaw City, Mich.; eastern slope of the Rocky Mountains, .79 at Fort Davis, Tex., and 1.23 at Poplar River, Mont.; plateau region, .49 at Yuma, Ariz., and .97 at Walla Walla and Spokane Falls, Wash.; Pacific coast, .45 at San Diego, Cal., and 1.39 at Port Angeles, Wash. In the upper lake region the ranges for February, 1888, exceed

the normal by about .40, while in New England they are about .40 less than the normal. In other districts the ranges differ but slightly from the normal.

AREAS OF HIGH PRESSURE.

During the month of February, 1888, seven areas of high pressure have passed over the region of observation. The centres of five of these areas were first located in the territory north of Montana and Dakota, and their general direction of movement was first to the southeast until over the central valleys, then in an easterly direction. Two areas were first observed in the central valleys.

The following is a brief description of each area, with the marked weather conditions prevailing during each:

I.—On the morning of the 1st this area was central over the Lake region, bounded by the isobar of 30.2, the highest central pressure being 30.36, at Green Bay, Wis. The movement of the area was easterly until central over western New York, then to the south until 10 p. m. of the 2d, when it passed to the ocean from the coast of North Carolina. The weather in all districts to the east of the ninety-second meridian during the 1st and 2d was fair, excepting in the southwest where rain, caused by the approach from the Gulf of an area of low pressure, was reported on the night of the 2d. Light winds prevailed, and only slight changes of temperature occurred.

II.—On the afternoon of the 2d the advance isobars of an area of high pressure extended over Montana, Dakota, and Minnesota. The area moved to the eastward, its centre remaining to the north of the region of observation until the night of the 3d, when it was central over Maine, with highest pressure, 30.46, at Eastport, Me., and at Boston, Mass. The area passed to the eastward of the Canadian Maritime Provinces after the 3 p. m. observation of the 4th. Light winds and generally fair weather accompanied this high pressure area in its movement to the eastward. On the night of the 3d and 4th it was accompanied by a cold wave which extended over New England and New York, the fall in temperature amounting to 20° in twenty-four hours.

III.—On the morning of the 4th an area of high pressure had extended over the northern slope of the Rocky Mountains and the upper Missouri valley, with central pressure, 30.44, at Q'Appelle. The track of the area was first to the southeast and then to the south. The pressure at the centre gradually decreased as the area moved to the southward, and on the morning of the 6th it had disappeared. On the night of the 4th and 5th a cold wave extended over eastern Dakota, Minnesota, Wisconsin, and Iowa, the fall in temperature ranging from 20° to 30°. The cold wave was greatly diminished in intensity as the area moved to the southward.

IV.—The approach of an area of high pressure from the northwest was indicated by increased readings of the barometer at stations in Manitoba on the afternoon of the 8th. At the succeeding observation the area had moved to the southeast and its centre was located to the north of Dakota. The movement continued to the southeast until central near La Crosse, Wis., when it was to the east. A cold wave over the middle and southern slopes of the Rocky Mountains, during which the fall in temperature ranged from 20° to 50°, occurred on the afternoon of the 9th, also a cold wave over New England on the night of the 9th and 10th, the fall in temperature ranging from 20° to 30°. Generally fair weather, with light winds, accompanied the area throughout its course.

V.—The approach of this high area was first apparent on the afternoon chart of the 13th, and its centre was located to the north of Dakota on the morning of the 14th. The pressure was highest on the morning of the 15th, when it was reported 31.04 at Prince Arthur's Landing; afterwards it gradually decreased until the afternoon of the 16th; when last observed the pressure at the centre was bounded by the isobar of 30.5. At 3 p. m. of the 15th the area of high pressure covered all of the United States to the east of the one hundred and seventh meridian, excepting New England. A cold wave, with front extending

northeast and southwest, advanced with the high pressure area over the United States to the east of the Rocky Mountains, excepting the south Atlantic states, Florida, and Alabama. The fall in temperature ranged from 20° to 50° in twenty-four hours, and at several stations in the middle and southern slopes of the Rocky Mountains at 3 p. m. of the 14th the fall amounted to 35° in the previous eight hours.

VI.—On the night of the 20th over an extensive region embracing the Ohio Valley and Tennessee, the upper Mississippi and Missouri valleys, and the middle and southern slopes of the Rocky Mountains, the atmospheric pressure was slightly below the normal, being everywhere above 30.00 and highest in the lower Missouri valley, where a small area was inclosed by the isobar of 30.10. An area of low pressure was central north of Lake Ontario, an area of high pressure was central on the north Pacific coast region, and a low pressure area was over the Gulf of Mexico. The pressure increased over the central valleys and the area moved to the eastward until the morning of the 22d, when it was central over Lake Erie and the pressure had reached 30.40. From its position over Lake Erie it moved to the southeast and passed to the ocean on the morning of the 23d. Within this area fair weather and light winds prevailed, and it was accompanied in its movement by only a slight fall of temperature.

VII.—This high pressure area apparently developed over Illinois on the afternoon of the 23d. The pressure at the centre was at first but little above the normal, but as it moved to the northeast the pressure increased, and when last observed over New Brunswick the barometer at the centre was 30.42 at Chatham. It was attended by fair weather and a slight fall in temperature.

AREAS OF LOW PRESSURE.

Nine well-defined areas of low pressure have been traced during the month of February over the territory covered by the tri-daily observations. These tracks are very irregular as to direction, varying greatly from the usual course. Two of the areas first appeared off the coast of Louisiana and travelled in a northeasterly direction; four were first observed to the north of Montana; one on the north Pacific coast; one in southeast Colorado, and one on the north shore of Lake Superior. During the month no barometric depression passed over the middle Atlantic states south of New York, or over the south Atlantic states.

The following table shows the latitude and longitude in which each area was first and last observed, and the average rate of movement of each area in miles per hour:

Number of area.	First observed.		Last observed.		Average hourly velocity.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
I.....	29 00	92 55	47 30	64 10	34.1
II.....	51 20	112 00	48 10	67 50	30.2
III.....	50 45	112 10	47 10	86 10	25.4
IV.....	48 30	123 30	47 30	77 00	55.2
V.....	49 20	87 10	44 15	65 55	47.5
VI.....	38 00	105 30	48 10	89 30	27.0
VII.....	51 35	114 00	47 10	90 00	28.4
VIII.....	28 00	92 30	49 00	65 30	27.9
IX.....	51 00	111 00	37 00	110 00	20.0

Average rate of progress, 33.2 miles per hour.

I.—This disturbance apparently developed over the Gulf of Mexico, to the south of Louisiana. It was at first limited in extent and of feeble energy, the central pressure being inclosed by the isobar of 29.9, but as it moved to the northeast it slowly expanded and increased in intensity. When last observed, 3 p. m. of the 5th, the lowest pressure was 29.48, at Chatham, N. B. The area was attended throughout its course by general rains or snows, light to fresh winds, and slightly higher temperature.

II.—This low pressure area was first observed on the afternoon of the 5th, extending from the region north of Montana to the southward, between two areas of high pressure, the one

central over Washington Territory and Oregon, the other central over Kansas. The pressure at the centre, at first but little below the normal, steadily decreased as the area moved to the southeast. On the morning of the 6th the lowest pressure was at Huron, Dak., and the storm began to move in a direction slightly to the north of east. It was last observed on the afternoon of the 8th, when it was central in the lower Saint Lawrence valley. It was attended by light snow or rains and brisk winds, becoming moderate gales over the Lake region on the 7th and 8th. The temperature rose slightly during the approach of the area, the greatest rise being in New England, where it amounted to 30° in twenty-four hours.

III.—A feeble depression was observed on the afternoon of the 6th, extending from the Northwest Territory to the southward along the Rocky Mountains. It moved to the southeast, and was central over Wyoming from 10 p. m. of the 6th till 3 p. m. of the 8th, when the movement toward the southeast was resumed. The area was very elongated in shape, its greatest length lying to the northwest and southeast. On the morning of the 9th the area had divided, one portion continuing to the southeast till central at New Orleans, La., then to the northeast, disappearing over Alabama on the morning of the 11th; the other portion remained, with slight change of position, over Colorado, Wyoming, and western Montana until the morning of the 12th, when apparently it had united with an area of low pressure then moving eastward from the north Pacific. Light local snows occurred over the northern and middle slopes of the Rocky Mountains from the 6th to 9th.

IV.—On the morning of the 12th an extensive area of low pressure, bounded by the isobar of 30.0, extended over the north Pacific region, the northern plateau, the northern slope, the Missouri Valley, and the upper Mississippi valley. The pressure was lowest (29.37) at Tatoosh Island, Wash. At the succeeding observation the area had divided. The eastern part moved to the southeast until 7 a. m. of the 13th, when it divided, one portion moving to the southward, disappearing over northern Texas, the other portion moving a little to the north of east, passing to the north of the region of observation. The western portion, without change of position, disappeared by gradual increase of pressure. The area was attended by heavy rains in the north Pacific region on the 12th, and by light snows, with light winds, over the Missouri valley, upper Mississippi valley, and the Lake region on the 13th.

V.—The existence of this depression was first apparent on the afternoon chart of the 16th. The centre was located to the north of Lake Superior, beyond the field of observation, and the southern portion only of the area extended over the Lakes.

The disturbance moved rapidly southeastward, passing off the coast of Nova Scotia on the afternoon of the 17th. It was attended by gales of twenty-five to thirty-five miles on the Lakes on the afternoon and night of the 16th, and by light snows over the New England States on the 17th.

VI.—At 10 p. m. of the 17th an extensive area of low pressure was observed, reaching from the territory north of Montana, the pressure being least over Montana and the northern half of Wyoming and Dakota, while another depression of less extent and less energy was central over Colorado. Both areas moved to the southeast, the former increasing and the latter rapidly decreasing in pressure. At 3 p. m. of the 18th both depressions appeared as one area of low pressure with two centres, one of which was located in southwest Kansas and the other north of Dakota. After 10 p. m. of the 18th the movement of the south centre was to the northeast. On the morning of the 19th the north centre had entirely disappeared, and the area was in shape an ellipse with longest axis extending in a northeast and southwest direction. At 7 a. m. of the 20th it was central over northern Michigan, the lowest pressure, 29.24, being reported from Escanaba. From this position the movement of the area was more easterly, and it was last observed central in the lower Saint Lawrence valley, the pressure at the centre having increased 0.2. It was accompanied by rain or snow throughout its course, and by brisk winds, becoming high over the Lake region.

VII.—This area of low pressure was observed bearing down from the northwest over Montana at 10 p. m. of the 22d. It moved to the eastward, continuing to extend to southward, until the afternoon of the 24th, when it was central over western Lake Superior. At the succeeding observation it had apparently united with an area of low pressure moving from the Gulf of Mexico to the northeast, and at that time central over northern Indiana. The depression was of feeble energy and was unattended by any change in the weather conditions, excepting a slight rise in temperature.

VIII.—This disturbance approached the coast of Louisiana from the Gulf of Mexico and moved in a direction slightly to the west of north until central near Shreveport, La., at 10 p. m. of the 23d. From this position it moved to the northeast until central over Lake Huron and the pressure at the centre rapidly decreased to 29.2. From Lake Huron it moved to the eastward until central over Maine, then again to the northeast, the central pressure slowly increasing. It was accompanied by light rains or snows, slightly higher temperatures, and brisk winds, becoming strong gales over the Lakes from the 24th to the 26th.

NORTH ATLANTIC STORMS FOR FEBRUARY, 1888.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that appeared over the north Atlantic Ocean during February, 1888, have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels, received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Ten depressions have been traced, of which, seven passed eastward from the American continent north of the fortieth parallel; one developed between Bermuda and the coast of the United States; one first appeared northeast of Bermuda, and one apparently originated east of the Azores. Of the seven depressions which advanced from the American coast, three moved northeast beyond the region of observation west of the thirtieth meridian, and four passed south of east and disappeared south or southeast of the Banks of Newfoundland. One depression pursued an irregular course in the vicinity of Bermuda; one moved northeast from south of the Banks of Newfoundland, and one has been given a south of east track over southern Portugal.

In February, 1887, twelve depressions were traced, of which,

six passed eastward over Newfoundland; one developed south of Nova Scotia, and five first appeared over mid-ocean. The depressions generally pursued east-northeast to northeast tracks, and in number and energy corresponded closely with the February average.

In February, 1888, the severest disturbances attended the passage of depression number 1, which moved northeast from south of the Banks of Newfoundland to the fifty-fifth parallel from the 1st to the 4th, inclusive. Of the remaining three depressions traced during the first decade of the month, number 3 alone exhibited marked energy, which, however, rapidly diminished with its advance southeastward from Newfoundland. From the 10th to the 13th, inclusive, fresh and strong north to west gales prevailed over the British Isles, attending the presence to the eastward or northeastward of an area of low barometric pressure. During the second decade four depressions of moderate energy appeared over the western portion of the ocean. Subsequent to the 20th two depressions moved eastward over northern Newfoundland, one of which, number 9, was accompanied by disturbances of considerable strength.